

IN THE DRAWINGS:

Replace Figure 1 with Figure 1 as found of the
Replacement Sheet attached hereto.

REMARKS

The Office action of January 31, 2008, has been carefully considered.

Figure 1 has been objected to and this figure has now been amended to note that it is "Prior Art."

Claims 5, 7 9-10 and 12 have been rejected under 35 USC 112, second paragraph.

The claims of record have now been canceled and replaced by a new set of Claims 14 through 26. Claim 5 corresponds to new Claim 17, which recites that the reinforcement increases in height over the front surface from a peripheral edge at the at least one working surface *in the direction of* the longitudinal axis. This structure is clearly shown in the drawings.

Regarding Claims 7, 9 and 10, Claims 19, 21 and 22 use the language suggested in the Office action.

Claim 12 has been replaced by Claims 24 and 25.

Withdrawal of this rejection is requested.

Claims 1, 3 and 6-10 have been rejected under 35 USC 102(b) by Tamamoto, and Claims 4 and 5 have been rejected under 35 USC 103(a) over Tamamoto.

In the application of ultrasonic welding, parts to be joined are compressed onto one another by a static welding strength. Welding of the parts to be joined takes place through the interaction of static and dynamic forces, without requiring additional materials.

In order to obtain reproducible welding results of high quality, deflection of the sonotrode should take place predominantly in the longitudinal direction, the direction of the ultrasonic oscillation. Deflection in a perpendicular direction is to be avoided.

When oscillations take place in the perpendicular direction, the working surface can run bent to the sonotrode

longitudinal axis, so that a gap can be formed between the working surface and the parts which run parallel to the longitudinal axis.

This problem is solved by providing a reinforcement for the working surface, either on the front and/or back surface of the head portion of the sonotrode. Accordingly, the invention is directed to a sonotrode for an ultrasonic welding device having a longitudinal axis, the sonotrode having a head portion comprising at least one working surface substantially parallel to the longitudinal axis, a front surface which is substantially perpendicular to the working surface and a back surface. The front surface and/or the back surface comprises at least one reinforcement for reducing deflection of the working surface.

The Tamamoto reference also deals with the problem of reducing the bending of the sonotrode during welding. In order to better discuss this reference, Applicants submit herewith a machine translation obtained from the Japan Patent Office website.

In order to solve the bending problem, Tamamoto provides a pressurizing jig 17 which is connected in a cantilevered fashion with the housing 11. The free end of pressurizing jig 17 faces the sonotrode phon (horn) 14. In addition, application-of-pressure child 20 abuts the horn 14, by which means the pressurizing jig and the child 20 form an integral body. Reference is made to paragraphs [0015] to [0017] of the detailed description of the invention.

Because child 20 is supported on horn 14, and both oscillate with the same frequency, undesired deflections of the sonotrode perpendicular to the longitudinal axis of the sonotrode are avoided; see paragraph [0017] of the detailed description. Thus, the solution offered by Tamamoto differs entirely from that according to the claimed invention.

The Office action takes the position that the sonotrode of Tamamoto projects beyond the front surface. This interpretation of the reference was made by taking into account the side view of the ultrasonic welding device, but considering the front surface as shown in Figures 3 and 5, it can be seen that tip 14' is fixed to sonotrode 14 by a screw or nut so that the tip 14' is actually a separate component and not the front surface of the sonotrode head. Accordingly, Tamamoto does not disclose a reinforced sonotrode head, and withdrawal of these rejections is requested.

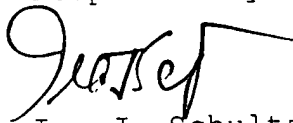
Claims 11-13 have been rejected under 35 USC 103(a) over Tamamoto in view of Ehlert et al.

Ehlert et al relates to rigid isolation of a rotary ultrasonic horn. As shown in Figures 3 and 8, a rotatable ultrasonic horn 28 passes through a rotatable axle member 34. According to paragraph [0039] of this reference, it is suggested that axle member 34 can provide a node plane 38, and the isolation member 42 can be located operatively approximate to the node plane of the axle member. This disclosure does not suggest a sonotrode having a front surface with a reinforcement and Ehlert et al does not therefore cure the defects of Tamamoto.

Withdrawal of this rejection is requested.

In view of the foregoing amendments and remarks, Applicants submit that the present application is now in condition for allowance. An early allowance of the application with amended claims is earnestly solicited.

Respectfully submitted,



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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings] :

[Drawing 1]The side view of the ultrasonic welding device of this embodiment of the invention 1.

[Drawing 2]The top view of drawing 1.

[Drawing 3]The front view of drawing 1.

[Drawing 4]The side view of the important section of drawing 1.

[Drawing 5]The partial front view of drawing 2.

[Drawing 6]The partial front view of the important section in the ultrasonic welding device of this embodiment of the invention 2.

[Drawing 7]The erection diagram of conventional technology.

[Description of Notations]

1 Ultrasonic welding device

14 14A Phon

17 17A Pressurization jig

18 The 2nd screw

19 19A Application-of-pressure child

[Translation done.]

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CLAIMS

(57) [Claim(s)]

[Claim 1]It is a device which gives supersonic vibration and performs welding processing with welding pressure to processing materials which made pile each other up and were supported, such as metal or a resin material, An ultrasonic welding device constituted so that nodal points of a phon might be pressurized in [which resonate an application-of-pressure child of a pressurization jig which pressurizes a phon on resonance frequency of a phon, and frequency about equivalent, and can make bending vibration / an oscillating resonant body and nothing], and its maximum amplitude point.

[Claim 2]The ultrasonic welding device according to claim 1 which connects an application-of-pressure child with a pressurization jig with a screw in nodal points in said application-of-pressure child.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention belongs to the field of the ultrasonic-jointing art which gives supersonic vibration to the member of piled metal or a resin material in which ultrasonic jointing is possible, and joins those members.

[0002]

[Description of the Prior Art] The ultrasonic welding device A as shown in the former, for example, drawing 7, is known.

[0003] If it is in this device A, the phon C which gives supersonic vibration to the processing material W laid on Ambil B. Bore E' of the diaphragm type resonance plate E connected with the support cylinder D is made to penetrate the boss C', It is the composition which was connected with the booster F arranged in the support cylinder D, and made bore E' of other diaphragm type resonance plates E penetrate boss F' of the booster F, and was connected with the converter G (known art).

[0004] In order to give high welding pressure to the processing material W in the tip position of the phon C, the technique arranged so that the processing material W may be pressurized in the minimum amplitude point (nodal points) position of the phon C itself is also assumed (well-known art).

[0005]

[Problem(s) to be Solved by the Invention] Even if it is in the device A of the aforementioned known art, exceptional trouble does not consist in pressurizing and carrying out welding processing of the processing material W, making the phon C supported in the shape of a support at one end generate supersonic vibration, but the technical-problem point which should be improved in addition is left behind.

[0006] Namely, as shown in drawing 7, when carrying out welding processing of the processing material W. Although it is desirable to give the welding pressure of the arrow (X) direction, since the phon C has a possibility that bending may occur in the direction of an arrow (Y) on the contrary according to the reaction force by Ambil B in this case, Welding

pressure was restricted and there was fault that restriction would be given in the thickness and area of a processing material as a result.

[0007]If it was in the aforementioned well-known art, it will originate in elasticity of the vibrating phon C itself, generation of heat and wear will occur in each part of connecting mechanism, there is a possibility of frequent maintenance inspection being not only needed, but becoming a cause of failure, and practicality was regarded as questionable.

[0008]The 1st issue that this invention tends to solve is providing what carried out previous prevention of the generating of the bending phenomenon of the phon like the above, reduced sharply restriction at the thickness of a processing material, or the point of area, and made quality welding processing possible.

[0009]The 2nd issue that this invention tends to solve has a simple structure, and is providing the outstanding thing which can be manufactured by low cost.

[0010]The 3rd issue that this invention tends to solve is the application-of-pressure child in a pressurization jig being connected stably, and providing what has maintenance free and high practicality.

[0011]

[Means for Solving the Problem]A concrete correspondence means to solve the aforementioned technical problem is as follows.

[0012](1) It is a device which gives supersonic vibration and performs welding processing with welding pressure to processing materials which made pile each other up and were supported, such as metal or a resin material, An ultrasonic welding device constituted so that nodal points of a phon might be pressurized in [which resonate an application-of-pressure child of a pressurization jig which pressurizes a phon on resonance frequency of a phon, and frequency about equivalent, and can make bending vibration / an oscillating resonant body and nothing], and its maximum amplitude point.

[0013](2) The above (1) which connects an application-of-pressure child with a pressurization jig with a screw in nodal points in said application-of-pressure child Ultrasonic welding device of a statement.

[0014]

[Embodiment of the Invention]

(Embodiment 1) If it is in the ultrasonic welding device of Embodiment 1 shown in drawing 1 - drawing 3, In the movable housing 11 which constitutes a vibration body, itself which were formed successively by making the point (P1) falling [rise and] into a fulcrum on the buck 10 of the letter of immobilization enabling free boom hoisting, The converter 13 and the booster 12 connected with this are allocated, The phon 14 is connected with the other sides of this booster 12 in the shape of a support at one end, and vibrator 14' of the heel of the phon 14 projected from the movable housing 11 is made to counter Ambil 15 formed successively to said buck 10 so that height adjustment was possible.

[0015]As shown in drawing 4 on the movable housing 11, the pressurization jig 17 is connected in the shape of a support at one end with the 1st screw 16, Make the free end of

this pressurization jig 17 overlook on said phon 14, and in the undersurface of the free end of this pressurization jig 17. Install the application-of-pressure child 19 and the ridge section 20 is made to contact said phon 14 with the 2nd screw 18, The pressurization jig 17 and the application-of-pressure child 19 are integral form, and itself constitutes a bending oscillating resonant body equivalent to the resonance frequency of the phon 14, As shown especially in drawing 5, said 2nd screw 18 is arranged in the nodal-points position (P2) of the application-of-pressure child 19, and it is constituted so that the ridge section 20 may be welded by pressure to the phon 14 in the maximum amplitude point (P3) in the mid-position of nodal points (P2).

[0016]21 in a figure is a height adjustment implement of Ambil 15 by a screw means, and enables repositioning of Ambil 15 whose rise and fall were enabled within the guide rail 22 to the buck 10 with the stretching screw 23.

[0017]Next, if it sees about the directions of this ultrasonic welding device 1, The point (P1) falling [rise and] is made into a fulcrum, starting the converter 13 and the booster 12 and vibrating the phon 14, after adjusting the height of Ambil 15 with the adjustment implement 21 according to the thickness of the processing material W beforehand. Although make it circle in the movable housing 11 counterclockwise (drawing 1), vibrator 14' is made to contact the processing material W, vibration and welding pressure are given to the processing material W and welding processing is performed on Ambil 15, Under the present circumstances, the bending to the clockwise rotation of the phon 14 by the reaction force of Ambil 15 is that in which the application-of-pressure child 20 of the pressurization jig 19 energizes the support-at-one-end-like phon 14 counterclockwise, Since the pressurization jig 19 and the application-of-pressure child 20 are integral form and itself constitutes the bending oscillating resonant body equivalent to the phon 14, Since the nodal points of the phon 14 will be pressurized in the diameter direction maximum amplitude point (P3), where energy loss is reduced, ultrasonic welding processing can be effectively made with high welding pressure.

[0018]About the 2nd screw 18, since the application-of-pressure child 19 is connected with the pressurization jig 17 in nodal points (P2), there is no possibility that the slack by vibration may occur, and it can be said that safety is high.

[0019](Embodiment 2) Although the thing of Embodiment 2 is shown in drawing 6, In a maximum amplitude point (P3) the different point of what is shown in drawing 5 by two ridge section 19A' of the application-of-pressure child 19A which the phon 14A is rectangular form and was installed in the pressurization jig 17A, It constitutes so that the phon 14A may be pressurized, and at the other point, since it is common in the thing of Embodiment 1, explanation is omitted.

[0020]

[Effect of the Invention]The characteristic effect brought about by this invention explained above is as follows.

[0021]** since previous prevention of the generating of bending of the oscillating means by

a force means is carried out, high welding pressure is given and welding processing can be carried out, also about a processing material with large thickness and area, carry out [obtaining and] welding processing effectively in the state of low energy, and come out.

[0022]** Since welding pressure is heightened and welding processing can be carried out, even if oscillation capability adopts the oscillator of a low comparatively, quality welding processing can be carried out.

[0023]** Since what is necessary is just to form the force means of a phon successively to an oscillating means, complication of structure can be avoided, it is a thing of simple composition, the force means is attached stably, and a maintenance service becomes easy.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention]This invention belongs to the field of the ultrasonic-jointing art which gives supersonic vibration to the member of piled metal or a resin material in which ultrasonic jointing is possible, and joins those members.

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PRIOR ART

[Description of the Prior Art] The ultrasonic welding device A as shown in the former, for example, drawing 7, is known.

[0003] If it is in this device A, the phon C which gives supersonic vibration to the processing material W laid on Ambil B. It is the composition which made bore E' of the diaphragm type resonance plate E connected with the support cylinder D penetrate the boss C', was connected with the booster F arranged in the support cylinder D, and made bore E' of other diaphragm type resonance plates E penetrate boss F' of the booster F, and was connected with the converter G.

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EFFECT OF THE INVENTION

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[0021]** since previous prevention of the generating of bending of the oscillating means by a force means is carried out, high welding pressure is given and welding processing can be carried out, also about a processing material with large thickness and area, carry out [obtaining and] welding processing effectively in the state of low energy, and come out.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]Even if it is in the device A of the aforementioned known art, exceptional trouble does not consist in pressurizing and carrying out welding processing of the processing material W, making the phon C supported in the shape of a support at one end generate supersonic vibration, but the technical-problem point which should be improved in addition is left behind.

[0006]Namely, as shown in drawing 7, when carrying out welding processing of the processing material W. Although it is desirable to give the welding pressure of the arrow (X) direction, since the phon C has a possibility that bending may occur in the direction of an arrow (Y) on the contrary according to the reaction force by Ambil B in this case, Welding pressure was restricted and there was fault that restriction would be given in the thickness and area of a processing material as a result.

[0007]If it was in the aforementioned well-known art, it will originate in elasticity of the vibrating phon C itself, generation of heat and wear will occur in each part of connecting mechanism, there is a possibility of frequent maintenance inspection being not only needed, but becoming a cause of failure, and practicality was regarded as questionable.

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MEANS

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[0017]Next, if it sees about the directions of this ultrasonic welding device 1, The point (P1) falling [rise and] is made into a fulcrum, starting the converter 13 and the booster 12 and vibrating the phon 14, after adjusting the height of Ambil 15 with the adjustment implement 21 according to the thickness of the processing material W beforehand. Although make it circle in the movable housing 11 counterclockwise (drawing 1), vibrator 14' is made to contact the processing material W, vibration and welding pressure are given to the processing material W and welding processing is performed on Ambil 15, Under the present circumstances, the bending to the clockwise rotation of the phon 14 by the reaction force of Ambil 15 is that in which the application-of-pressure child 20 of the pressurization jig 19 energizes the support-at-one-end-like phon 14 counterclockwise, Since the pressurization jig 19 and the application-of-pressure child 20 are integral form and itself constitutes the bending oscillating resonant body equivalent to the phon 14, Since the nodal points of the phon 14 will be pressurized in the diameter direction maximum amplitude point (P3), where energy loss is reduced, ultrasonic welding processing can be effectively made with high welding pressure.

[0018]About the 2nd screw 18, since the application-of-pressure child 19 is connected with the pressurization jig 17 in nodal points (P2), there is no possibility that the slack by vibration may occur, and it can be said that safety is high.

[0019](Embodiment 2) Although the thing of Embodiment 2 is shown in drawing 6, In a maximum amplitude point (P3) the different point of what is shown in drawing 5 by two ridge section 19A' of the application-of-pressure child 19A which the phon 14A is rectangular form and was installed in the pressurization jig 17A, It constitutes so that the phon 14A may be pressurized, and at the other point, since it is common in the thing of Embodiment 1, explanation is omitted.

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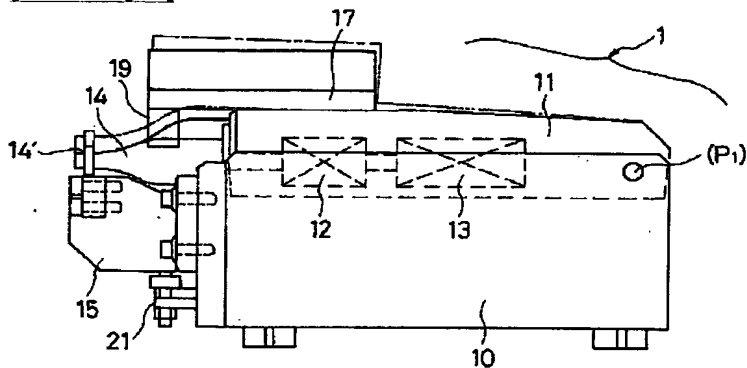
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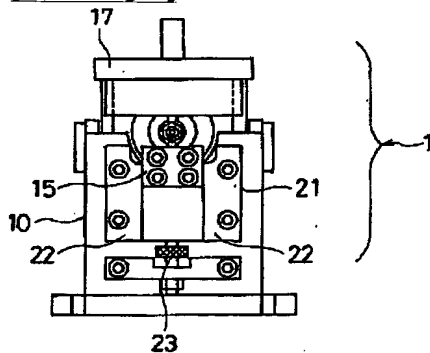
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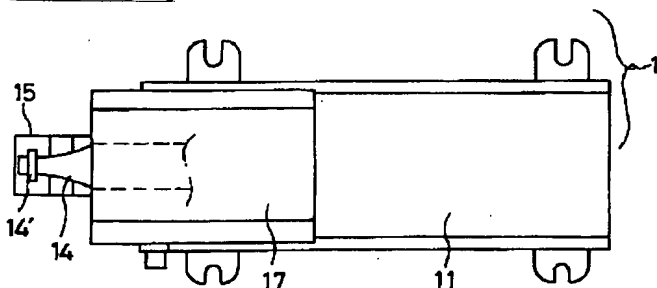
[Drawing 1]



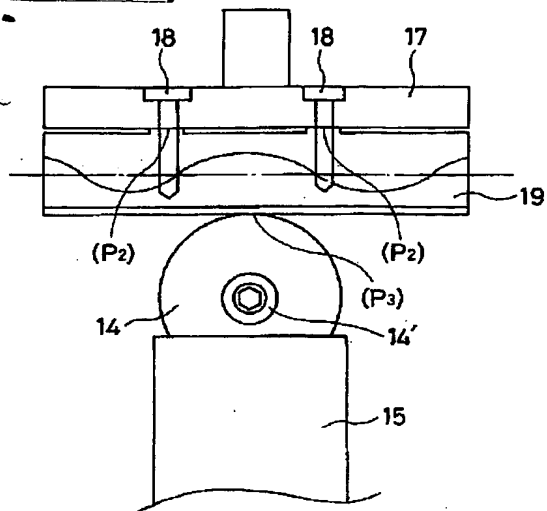
[Drawing 3]



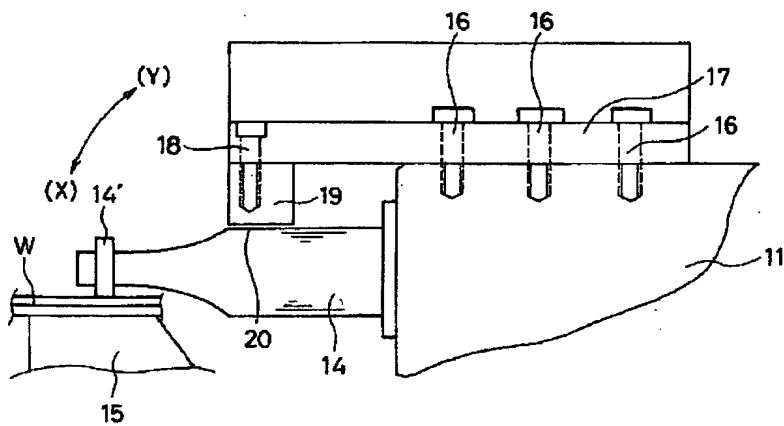
[Drawing 2]



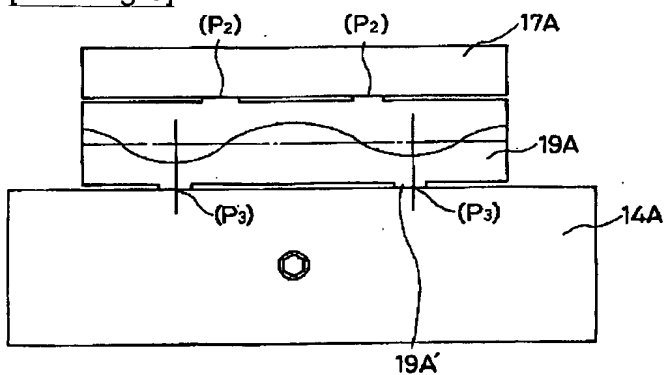
[Drawing 5]



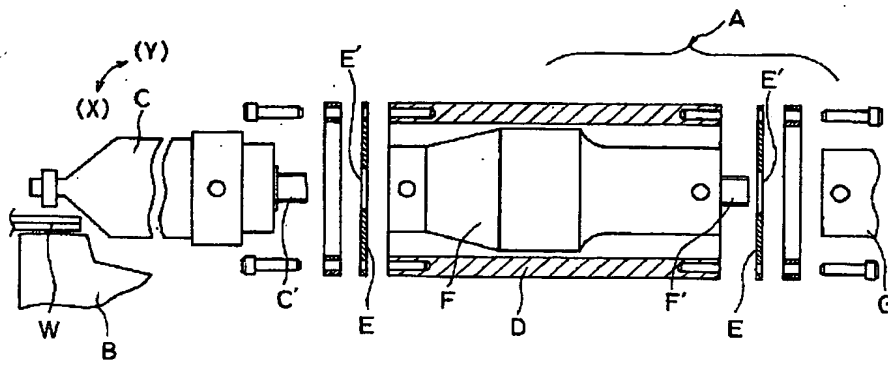
[Drawing 4]



[Drawing 6]



[Drawing 7]



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